06284

Radiodetection®

RD400 LLTS

Long Line Tracing System

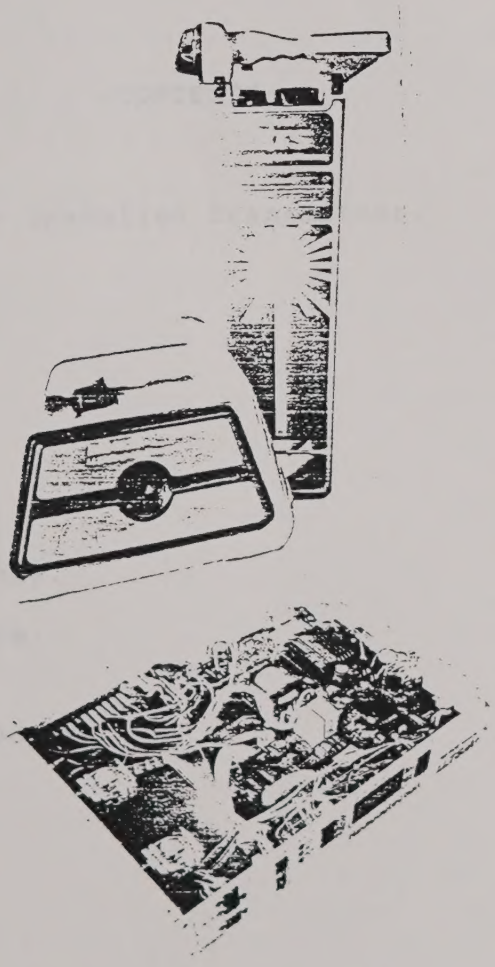
Installation handbook

Radiodetection
Bristol BS14 0AZ
United Kingdom
PObox 623, Ridgewood NJ 07450 USA

RD430 Long LIne Tracing System

RD431 Installed Transmitter

Installation Instructions



LLTS/A

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1.0 -The RD430 System-

The RD430 System is a locating system specifically designed to solve the problems of locating long buried lines positively and accurately. Prime applications are telecommunication transmission lines, especially new longer optical fibre links, and major gas transmission lines.

It enables rapid and simple re-location of long sections of buried transmission line and is particularly useful when access points are widely spaced or have difficult access.

The system comprises three basic units.

1.1 -RD431.- An audio frequency signal transmitter designed to be installed at regular equipment stations along the line. The unit is powered by local on-line power supplies. Its features include telemetry based remotely addressable switch-on systems and equipment status feedback.

1.2 -RD432.- A hand held LineTrace receiver for locating lines that have been energized by an RD431 or the RD433 portable transmitter. Its features include push-button depth measurement, dual mode peak/null operation and dual locating frequencies. Full user instructions for the RD432 and RD433 are contained in their user handbook.

1.3 -RD433.- A portable transmitter to complement the permanently installed RD431. It is fully compatible with the RD432 LineTrace receiver and is used whenever there is a requirement to trace a buried line that for some reason is not carrying a signal from the RD431 transmitter. Its features include energize modes not available on a permanently installed transmitter; induction mode and an optional signal clamp.

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2.0 -RD431 Transmitter-

This handbook describes only the RD431 transmitter. It comprises instructions for correct installation, calibration, maintenance and use of the equipment.

Separate sections also provide details of post-installation signal integrity check surveys and accessories that are available to enhance performance.

Please note that correct installation is of paramount importance; one of the key advantages available to RD430 users is that the locate signal is always known to be there when it is needed. Thorough adherence to the recommended installation and post-installation procedures will ensure best possible performance.

3.0 -Controls-

3.1 -Front Panel.-

-"Off/On"- lamp. Lamp lights to indicate successful connection of the power supply.

-"Off/On"- momentary push switch. A single operation of the switch causes the unit's status to change from off to on or from on to off.

-"Manual/Telemetry"-
"Manual" enables the front panel mounted on/off push switch; in this position ,the transmitter's status can be changed either by the front panel switch or by the rear panel telemetry input. In "Telemetry" position, the unit's status can only be changed by a rear panel input; the on/off switch is disabled to prevent inadvertent operation.

-"Status"-, -"OK"- & -"Failed High/Low"- lamps.
The lamps reflect the output current status as defined by the set level, programmed by the user. If the output current is greater than the set level the failed "High" lamp will light. If the output current is less than the set level the failed "low" lamp will light.
The levels are set by adjusting the screwdriver controls on the front panel. Levels should be set at least 10% lower and higher than nominal output level. For example, if the output level is displayed as 100mA, the higher level should be set to at least 110mA and the lower to less than 90mA.

-"Set"-push switches. A momentary switch which changes the meter display to read the levels currently set into the status monitoring circuitry.

-"Adjust"- controls. Screwdriver operated controls for altering the High/Low status level. Used when "set" mode has been selected. Clockwise operation increases the level.

-"Amps/Volts"- momentary push switch. The LCD meter

normally displays the transmitter output current in mA. The meter reads output voltage instead while this switch is depressed.

-"Output/Line"- momentary push switch. Transmitter output is disabled while this switch is depressed. This function is available so that the built in meter can be used to monitor any standing voltage or current (depending on the status of the Amps/Volts switch) that is present on the line.

-"Frequency, Low/High"- Selects the required transmitter frequency. One of the two lamps will light to indicate the selected frequency.

3.1.1 MULTI-FREQUENCY OPTION

Users with the Radiodetection Multi-frequency (MF) option have a choice of frequency selection. The user can select standard Radiodetection frequencies OR one Radiodetection frequency and ONE of five other frequencies.

The LLTS is factory set with standard Radiodetection frequencies, as designated on the rear panel. To change one of these frequencies to the Multi-frequency option perform the following:

1. Remove the LLTS top cover.

2. Identify links LK1-LK4 on the smaller circuit board attached to the LLTS back lid and program the required frequencies from the table below.

LINK	LINK	FRONT PANEL (frequency select Hz)	
		low	high
1	4	512	8192
2	4	512	MF
1	3	MF	8192

Identify the rotary switch on the same circuit board.

POSITION 1: 9820 Hz

POSITION 2: 990 Hz

POSITION 3: 815 Hz

POSITION 4: 577 Hz

POSITION 5: 153 Hz

For example if links 2 & 4 are selected and the rotary switch is set to position 1, the "low" frequency will be 512Hz and the "high" will be 9820Hz.

3.1.2-Timer- Automatically switches unit off after time duration as defined by front panel thumbwheel switch(Hrs). The timer is disabled when switch is in up position. To enable timer push switch to "on" position and timer lamp will light. Select number of hours required (0-9hrs).

3.2 -Rear Panel controls.-

-"Serial no."- box. Please quote serial number if requesting spare parts or if experiencing operational difficulties.

-Ground connection.- Green terminal to enable connection of the case metalwork to local ground potential if required. The case is not in electrical connection with any part of the circuitry and can therefore be connected to positive or negative ground systems if necessary.

-"Output Level"- adjustment. Screwdriver control to enable presetting or fine control of the output level in order to achieve a particular level for safety or operational reasons.

-"Signal Output, Fuse"-. Holder for 1.25in, 2A fuse that protects the transmitter output.

-"Power Supply, Fuse"-. Holder for 1.25in, 4A fuse that protects the unit's power supply and wiring.

SHIELDED SCREW TERMINAL BLOCK:

-Status o/p- Contacts close to indicate output high or low with respect to set limits.

-Telemetry input- For connection to a remotely controlled relay system. A momentary (greater than 0.2 sec) short circuit (less than 100ohms) will cause the transmitter to

change state (on to off or off to on).

-Aux Enable- Contacts closed when on. Used to power up auxillary equipment if required.

-Output Match- Impedance matching for signal optimization.

-Signal Output- Connection for signal output.

- +/- 48V Power Supply- Nominal 48V supply.

4.0 -Installation-

The RD431 is designed for installation inside a building although weatherproof housings are available if required.

4.1 -Location.- Choose a location that will be convenient for access to both power supply lines and to the lines to be energized.

Do not obstruct the airflow around the rear panel mounted heatsinks or the unit may become overheated.

4.2 -Brackets.- The standard case is in 19in. rack mounting format but accessory brackets enable vertical wall mounting or 23in. rack mounting. Assemble the brackets as illustrated on page 12.

4.3 -Rear Panel Connections.- All rear panel wiring is protected behind a plastic panel that prevents tampering or electrical access to live parts. The terminals are accessed by removing the four retaining screws.

4.3.1 -Power Supply.- Connect 5A rated cable to the specified terminals and to the power supply. The supply should be regulated so that, on or off load, the voltage, including any ripple is always between 44v and 52v. When connected, the "power" lamp should light. If not, check that supply is present on the terminals; check polarity and check that a sound fuse of the correct rating is fitted.

Check that the front panel on/off control functions as desribed in section 3.1.

4.3.2 -Telemetry input.- (Optional) Connect the two terminals to the desired relay contacts. Operate the relay via the remote link and check that

transmitter switches on and off.

4.3.3 -Signal Output Connections.- Switch the transmitter off before making output connections. Two connections need to be made. The connections are made so that a circuit is completed between the terminals and so that the target line forms a part of the circuit.

There are several points that need to be observed:

Try to avoid using station ground or other buried lines as earth points; the earth quality will be high, resulting in a strong signal, but there will be significant trace signals on the other buried services which may be confusing.

A good quality low resistance ground connection is essential for high strength signal which, in turn, is essential if long distances are to be energized/traced.

If line/ground connections are used, the line needs to be locally isolated from ground or else the signal will return to ground almost immediately, resulting in very little signal actually propagating along the line.

If the RD431 is positioned at a midpoint of the line, as opposed to at the end, the line can be energized in both directions simultaneously. There are two techniques:

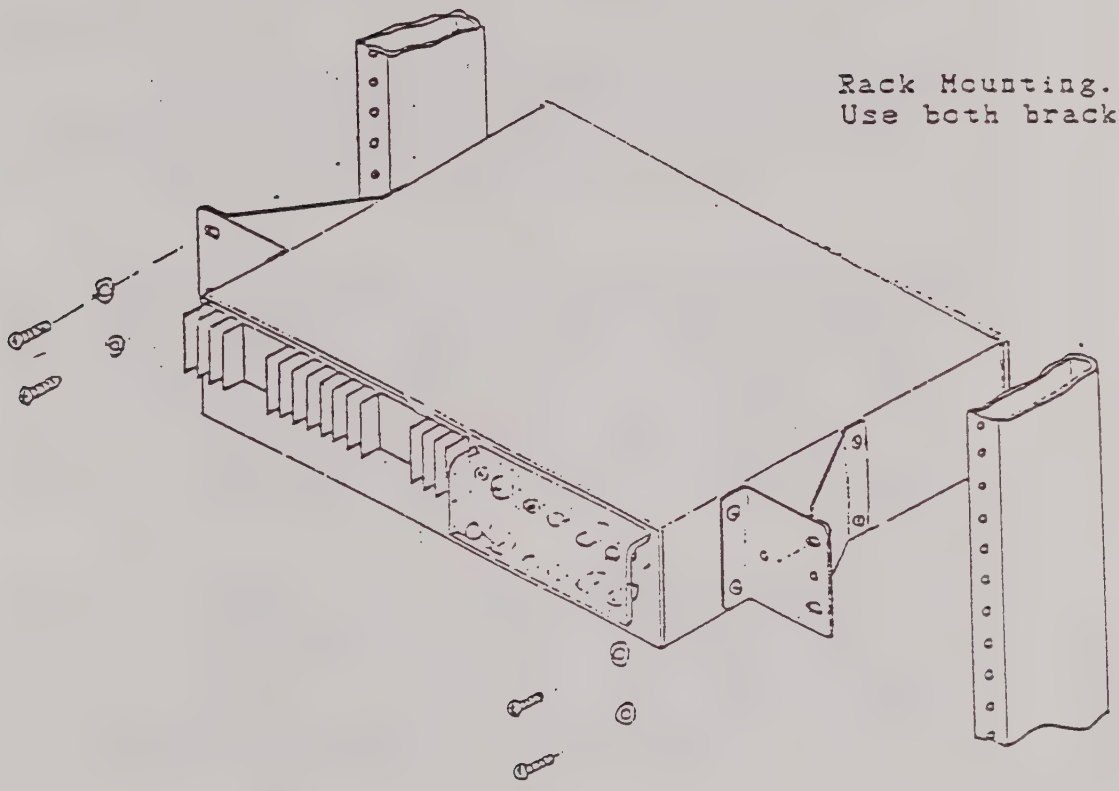
4.3.3.1 Simple line/ground connection- as previously described, both sections of line being bonded together and free from ground.

4.3.3.2 -Line/line connection.- Seperate the two sections of line, isolate both from local ground, and connect one transmitter terminal to one line and the other terminal to the other line; no ground connection.

Both techniques are valid but method 4.3.3.2 is usually better providing the two lines can be isolated from each other and providing the effective ground impedance that the signal sees along each wire is relatively low. Try one technique and if the signal strength or range is inadequate, try the other; it may be better.

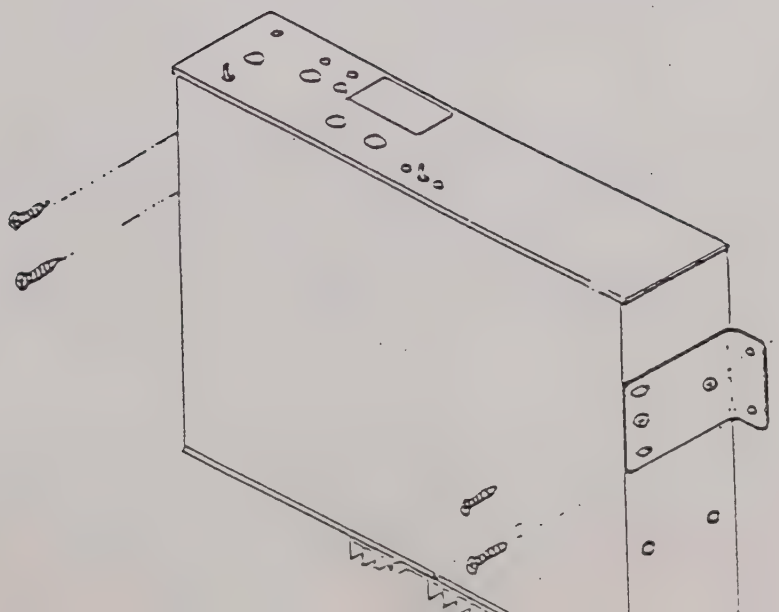
Note that the two output terminals are short circuited by an internal relay when the unit is not switched on.

Mounting brackets. Fig. LL0802



Rack Mounting.
Use both brackets.

Wall mounting.
Use brackets 1 only.



5.0 -Setting UP

Connect the transmitter as described previously; power supplies, optional telemetry input and signal output connections. Turn the rear panel output level cotrol fully clockwise. Do not switch on.

5.1 -Frequency.- Select low frequency. This is the preferred mode for long range tracing. The signal will decay more slowly than higher frequencies and there will be less tendency for it to transfer to other adjacent lines. High frequency is only used when low cannot be used; either because a suitably matched low frequency receiver is not available or because high local electrical noise is causing unacceptable interference in the low frequency mode.

5.2 -Impedance matching.- The RD431 output circuitry includes an impedance matching section whose function is to ensure that the equipment's available output power is used as efficiently as possible. In automotive terms, it is equivalent to a (manual!) gearbox. The impedance must be manually selected on installation.

5.2.1 - Preperation.- Identify on the rear panel the output match section. Set the purple connector between position "Com." and 1. Succesful operation of the system should be indicated by a non-zero meter reading.If meter reads zero check the quality of the output connections and the output fuse.

5.2.2 -Line check.- At this stage, if an output current meter reading has been obtained, the line current and voltage should be checked in order to be sure that the presumed output level really is output and is not all due to the line. Press "output/line" to observe the level of line current and then "output/line" and "Amps/Volts" to observe line voltage. Record both values.

Line voltage should be less than 50v. If it is not, immediately switch off and disconnect the signal output connections: damage may result from prolonged connection to higher voltages.

Line current should be significantly lower than previously observed output current. High line current is not an actual problem; it just makes it difficult to get meaningful results from the output meter.

5.2.3 Impedance Testing.- Having noted the output current level when impedance position 1 selected, switch the transmitter off. If the current was in excess of 400mA, the right impedance mode has been selected but if it also exceeds 640mA, the rear panel level control must be adjusted anticlockwise until the current is 640mA, or less. The impedance is now matched.

If the noted current is less than 400mA, select position 2, switch on and re-check the current level. If the current falls to between 260mA and 400mA, impedance is now matched. If it exceeds 400mA, the rear panel level control must be adjusted anticlockwise until the current is 400mA, or less. The impedance is now matched.

If the noted current is now less than 260mA, switch off, select position 3, switch on and re-check the current level. If the current falls to between 180mA and 260mA, impedance is now matched. If it exceeds 260mA, the rear panel level control must be adjusted anticlockwise until the current is 260mA, or less. The impedance is now matched.

If the noted current is now less than 180mA, switch off, select position 4, switch on and re-check the current level. If it exceeds 180mA,

the rear panel level control must be adjusted anticlockwise until the current is 180mA, or less. The impedance is now matched.

5.3 -Output Level.- The level should not be increased beyond the settings now established. However, if it is preferred that the output voltage is limited for safety reasons, reduce the adjustment until that level is achieved.

5.4 -Status Monitor.- At this stage, the line should be surveyed with the LineTrace receiver to determine that the signal is of adequate strength and is present on the correct lines as detailed in Section 8.

Once a satisfactory output level has been confirmed, the status monitor level can be set so that meaningful feedback is possible.

The status monitor is used to signal that status is "OK" when the output level is between a preset limit.

A margin between the status levels and the actual output level is necessary because the output current will fluctuate slightly as a result of climate induced variations in local ground resistivity and other factors.

The level is set by selecting "set" modes and adjusting the front panel screwdriver-control so that the meter reads the desired levels.

5.5 -Status Output.- The status output terminals can be wired up to the selected telemetry system sensors.

6.0 -Protection-

6.1 -Fuses.- Neither of the two fuses, if the correct rating is used, should ever fail. If a failure occurs, it should be assumed that the equipment or installation is faulty. DO NOT replace the fuse until a reason for its failure has been found and remedied. One possible reason is excessive line voltage; see section 6.2.

6.2 -Line Voltage.- Section 5.2.2 mentions the problem of high line voltage. The RD431 will tolerate line voltages of up to 50v dc or 150v ac (60Hz). If higher voltages are present, the unit may be damaged.

In order to use the RD431 in the presence of these higher voltages, it will be necessary to first fit an inductive shunt in the form of a blocking filter. See section 7.

6.3 Lightning protection. In order to preserve the normal requirement for having cable sheaths bonded to ground, the RD431's output terminals are short circuited via 20A rated relay contacts when the unit is switched off. This provision can be removed if necessary by disconnecting the wires running from the output terminals to the large chassis mounting relay.

There is a gas discharge surge arrester connected directly across the output terminals which is capable of shunting transient voltage spikes to supress the effect of a lightning strike. The actual rating of the device is detailed in section 10. Higher ratings can be fitted if specified.

7.0 -Line filters

If the RD430 system is used to protect cable systems, the conductor to which the signal is applied -must- be wholly isolated from ground except for at its far end. If the conductor is the cable sheath and it is deliberately grounded at regular intervals, the applied RD431 signal is also grounded and therefore seriously attenuated at each bonding point. The result is that the signal's range is drastically reduce.

The ground bonds must be removed.

If safety or operational considerations dictate that the cable must be grounded, Radiodetection blocking filters should be used. These filters comprise passive reactive components which exhibit a high impedance path to ground for the RD431 signal and a much lower impedance for 50/60Hz or DC voltages.

Blocking filters are available in a wide range of ratings to satisfy different requirements. Contact your Radiodetection Represantative and specify the maximum current levels (DC or AC) that the filters need to handle. Do not be tempted to over specify; cost of these items is proportional to current handling capability.

These filters can be used across the output of the transmitter to shunt excessively high output voltages to ground as mentioned in section 6.2.

Signal passing filters are also available to enable the RD431 signal to be passed from one line to another whilst retaining effective electrical isolation to other frequencies.

8.0 -Signal check survey-

One of the key advantages of the RD430 system is that the signal is always known to be present when it is needed. Clearly, installation must be followed by an in situ survey that checks the system integrity.

Ideally, an operator would walk the entire protected route with his RD432 receiver, checking that the signal is present and of adequate strenth along the entire length as well as checking adjacent services for traces of stray signal.

In practice, it is probably sufficient to check signal at a handful of different sites distributed along the line. If the signal is present in sufficient strength everywhere, the survey is complete. If the signal fades out prematurely, the operator must identify the cause.

8.1 -Current gradient survey.- Radiodetection data sheets #020 & #021 give very thorough details about the current gradient survey. It is a technique which allows the decay of current along a line to be monitored. If signal has been applied to a "perfect" line, it should decay at a consistent rate; if the line has anomalies such as occasional ground connections (whether accidental or deliberate), the signal can be observed decaying in a series of steps. Each step corresponds to a point where signal is being lost to ground.

8.2 With an RD600CM- receiver, tuned to the appropriate frequency, a very thorough survey can be undertaken. It is capable of finding points where just a few % of the signal is escaping. Its use is described in the data sheets.

8.3 With the standard RD432 LineTrace receiver, useful information can be realised by making and recording a

Take a first reading at least 200m/yards from the signal source to avoid interference from the stray returning ground currents.

Locate the line, measure its depth and set the sensitivity so that the meter reads 100%. Take care to leave this setting unaltered until the next reading is taken.

Move to the next convenient access point; this should normally be about 1 mile, 1.5km, distant.

Without altering the sensitivity, re-locate the line and check the signal strength on the meter. Measure the depth of the line.

These two readings should establish a line "fingerprint"; an indication in percentage of how much signal the particular line can be expected to lose over a distance of 1 mile. Typically, this might be around 50% but because of the widely varying characteristics of different types of line, it could be anywhere between 15% and 85%.

If the two readings are made at different depths, try to make a rough compensation; if the depth at the second survey point is slightly greater, then compensate by making the second reading slightly larger.

Repeat the exercise, comparing signal level at the second site with the level at a third site and so forth.

If the survey intervals are kept reasonably consistent and depths are similar, the survey should result in a series of percentage readings that are also similar, eg. if signal drops by 70% in the first mile, it should drop by 70% again over the second mile.

Any significant variation from the norm suggests an unwanted ground connection. It must be located and rectified in order to achieve the best possible location range. Radiodetection's FF ground fault locator may be of assistance.

9.0 -Routine maintenance-

The RD430 has no parts that should require routine replacement or service.

Fuse replacement is discussed in section 6.

The actual output current of the device should be monitored and recorded at regular intervals, eg. every three months. If it is seen to deviate significantly, the status monitoring system at least will require re-setting in accordance with section 5.4

If output current deviates by more than 30%, the setting up procedure should be repeated to ensure that the correct output level and/or impedance is being used, -especially- if the current has increased.

Output current should only deviate in response to changes in the electrical impedance of the circuit to which the RD431 output is connected. The transmitter itself has a very stable output system which should prevent actual output drive level drifting noticeably.

June 24, 1988

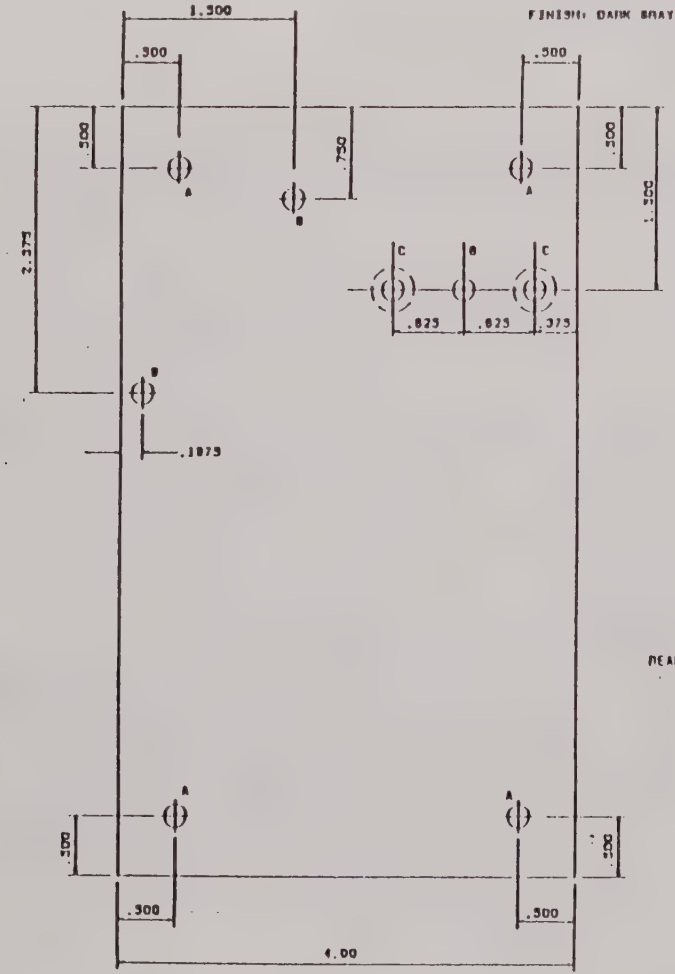
This is the Headquarters approved wiring hook up for "LLT" (Remote Cable Locating System).

These drawings are for hook-up in the CEV/LRS and for Central Office.

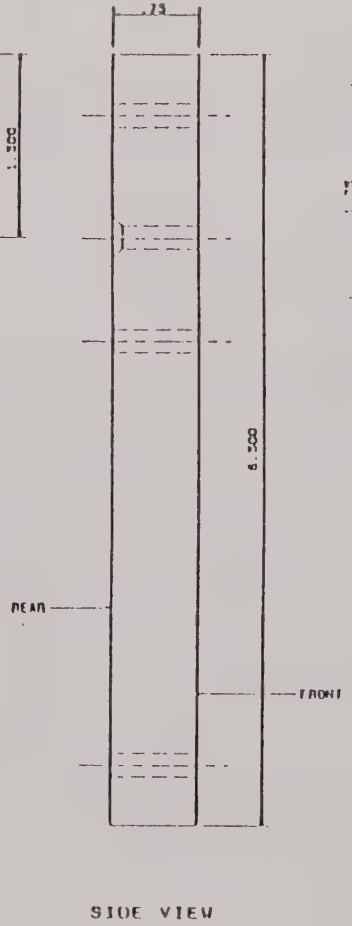
Chris Collier
Supervisor
SNBR - FTAG
714+381-7846

DETAIL A

MOUNTING BLOCK
(3/4" PLYWOOD)
FINISH: DARK GRAY-ENAMEL



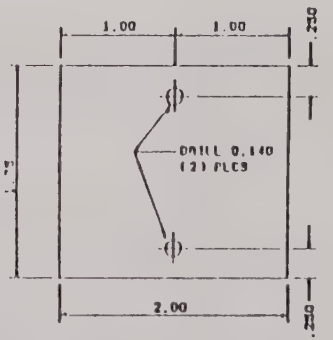
FRONT VIEW



SIDE VIEW

DETAIL B

PROTECTIVE COVER
(1/8" LEXAN - CLEAR)



FRONT VIEW

SIDE VIEW

DRILL TABLE

DETAIL A

A - DRILL 0.187 (4) PLCS
B - DRILL 0.109 (3) PLCS
C - DRILL 0.140 (2) PLCS
(COUNTER SINK FOR #8
FLAT HEAD SCREW ON
REAR SIDE OF BOARD)

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CABLE GROUND CONTROL
(REMOTE CABLE LOCATION
TRANSMITTER ARRANGEMENT

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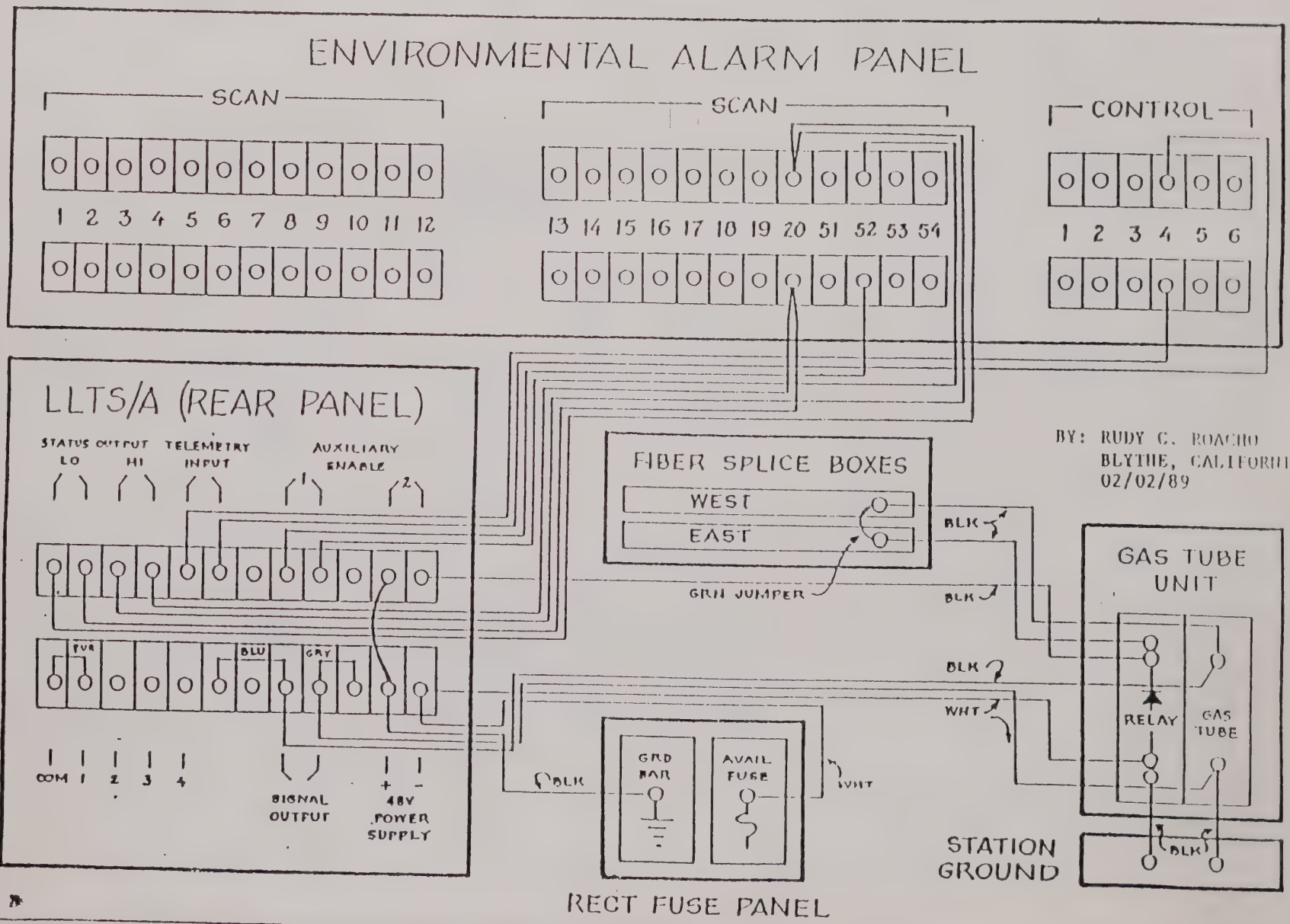
LLTS/A REMOTE CABLE LOCATER SYS



10.0 -Specification-

- Frequencies: Low: 512Hz
  High: 8192Hz
- (usual settings, see panel for actual frequencies of a particular unit)

- Output power: 15W

- Nominal output levels:

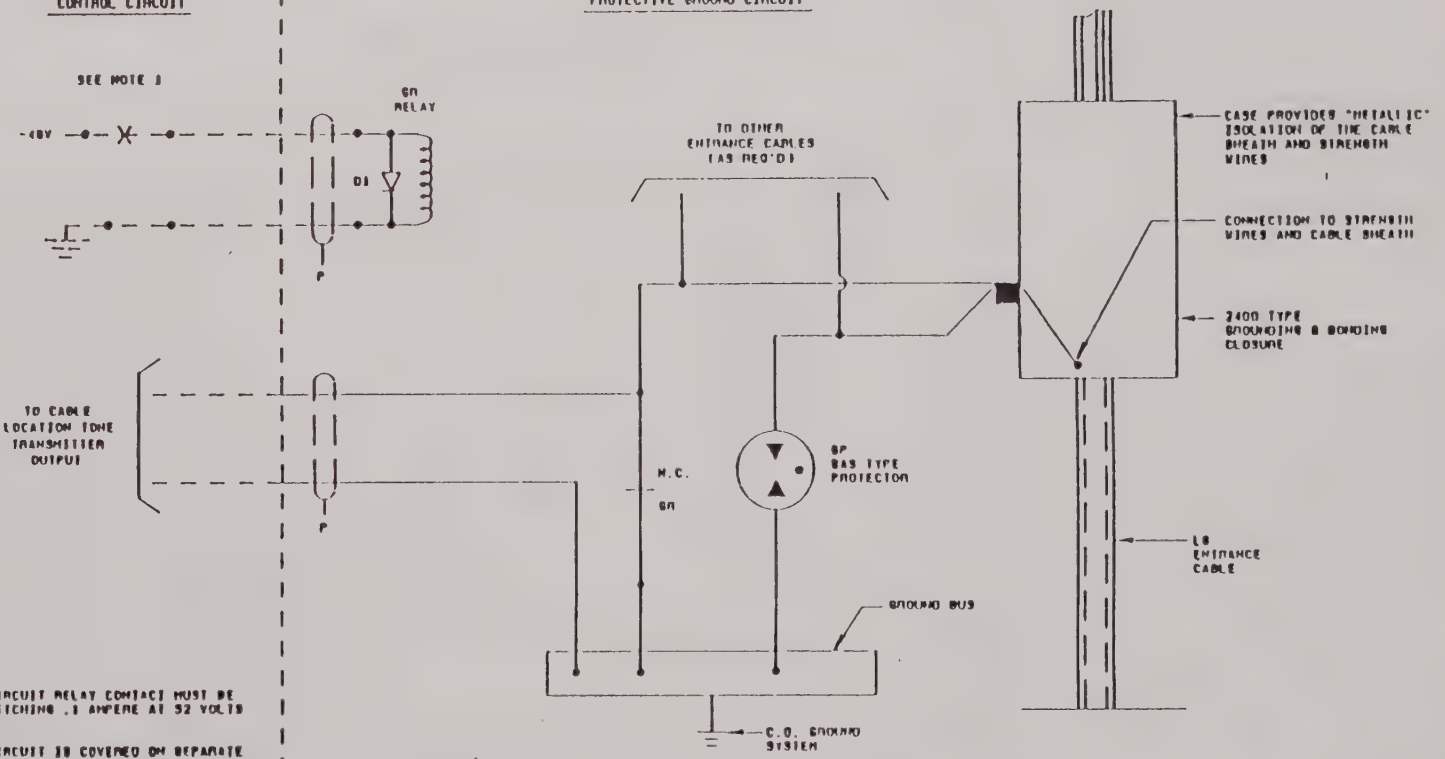
Impedance position	O/C Volts	Max. Current
1	27v	640mA
2	41v	400mA
3	62v	260mA
4	89v	180mA

- Operating Temperature: -15C to 40C

- Surge arrester:

DC sparkover: 195v to 265v

Impulse Discharge Current: 5kA, (CCITT 8/20)



NOTE 1:

THE CONTROL CIRCUIT RELAY CONTACT MUST BE CAPABLE OF SWITCHING .1 AMPERE AT 52 VOLTS DC.

THE CONTROL CIRCUIT IS COVERED ON SEPARATE DRAWINGS AND WILL VARY DEPENDING ON EQUIPMENT MANUFACTURE, OPTIONS AND VINTAGE.

CIRCUIT DESCRIPTION:

THE PURPOSE OF THIS CIRCUIT IS TO PROVIDE PRIMARY AND SECONDARY LIGHTNING AND POWER FAULT PROTECTION AT LIGHTGUIDE LOCATIONS WHERE REMOTE CONTROLLED CABLE LOCATION TONES ARE APPLIED. IN THE TONE "OFF" CONDITION, RELAY (GA) IS NOT OPERATED. THE ENTRANCE CABLE STRENGTH WIRES AND SHEATH ARE CONNECTED TO GROUND VIA THE NORMALLY CLOSED CONTACT OF RELAY (GA).

IN THE TONE "ON" CONDITION, RELAY (GA) IS OPERATED. IN THIS CONDITION PROTECTION IS PROVIDED BY THE GAS TUBE PROTECTOR (GP). PROTECTOR (GP) IS NON-CONDUCTIVE AT VOLTAGES LESS THAN 230 VOLTS THEREBY ALLOWING THE CABLE LOCATION TONE CURRENT TO FLOW TO THE THE CABLE SHEATH.

DIODE (D1) SUPPRESSES THE VOLTAGE TRANSIENTS GENERATED BY THE OPERATION OF RELAY (GA).

RELAY (GA) HAS A NOMINAL RESISTANCE OF 300 OHMS AND REQUIRES A MINIMUM OF .080 AMP FOR OPERATION. CURRENT FOR OPERATING RELAY (GA) IS FURNISHED FROM THE TONE LOCATION TRANSMITTER OR ASSOCIATED CONTROL INTERFACE.

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SHEET 1 OF 3

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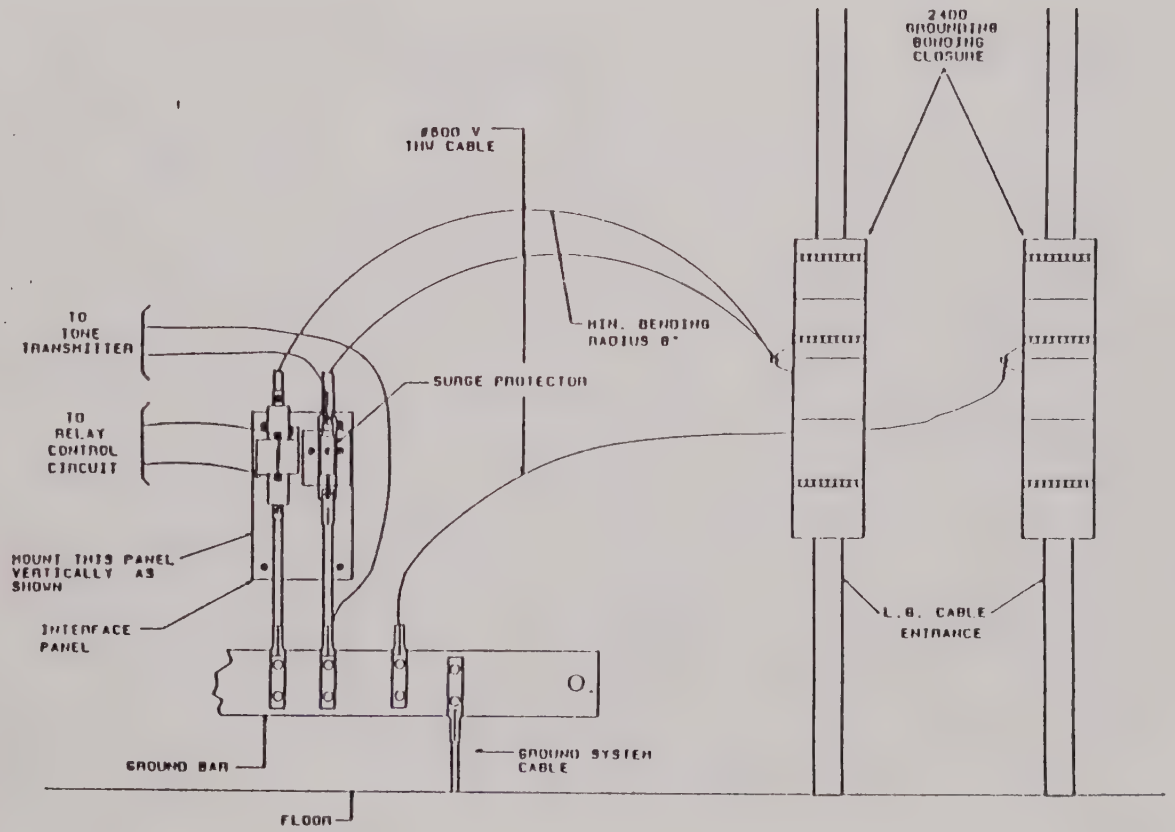
TRANSMITTING ARRANGEMENT

ONE DIRECTION FEED
(REGENERATOR LOCATION)



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CABLE GROUND CONTACT
(REMOTE CABLE LOCATION TONE TRANSMITTER ARRANGEMENT)

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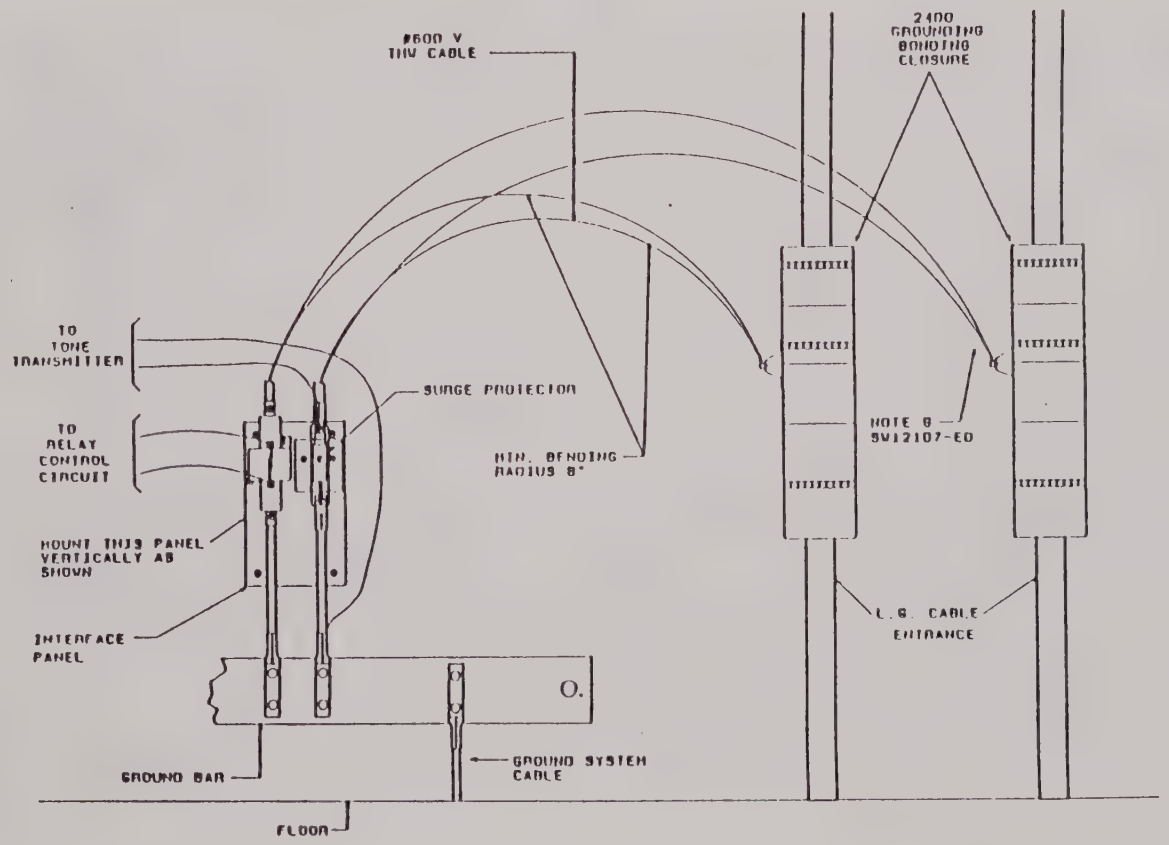
TRANSMITTING ARRANGEMENT

TWO DIRECTION FEED
(REGENERATOR LOCATION)



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CABLE GROUND CONTROL
(REMOTE CABLE LOCATION TONE
TRANSMITTER ARRANGEMENT)

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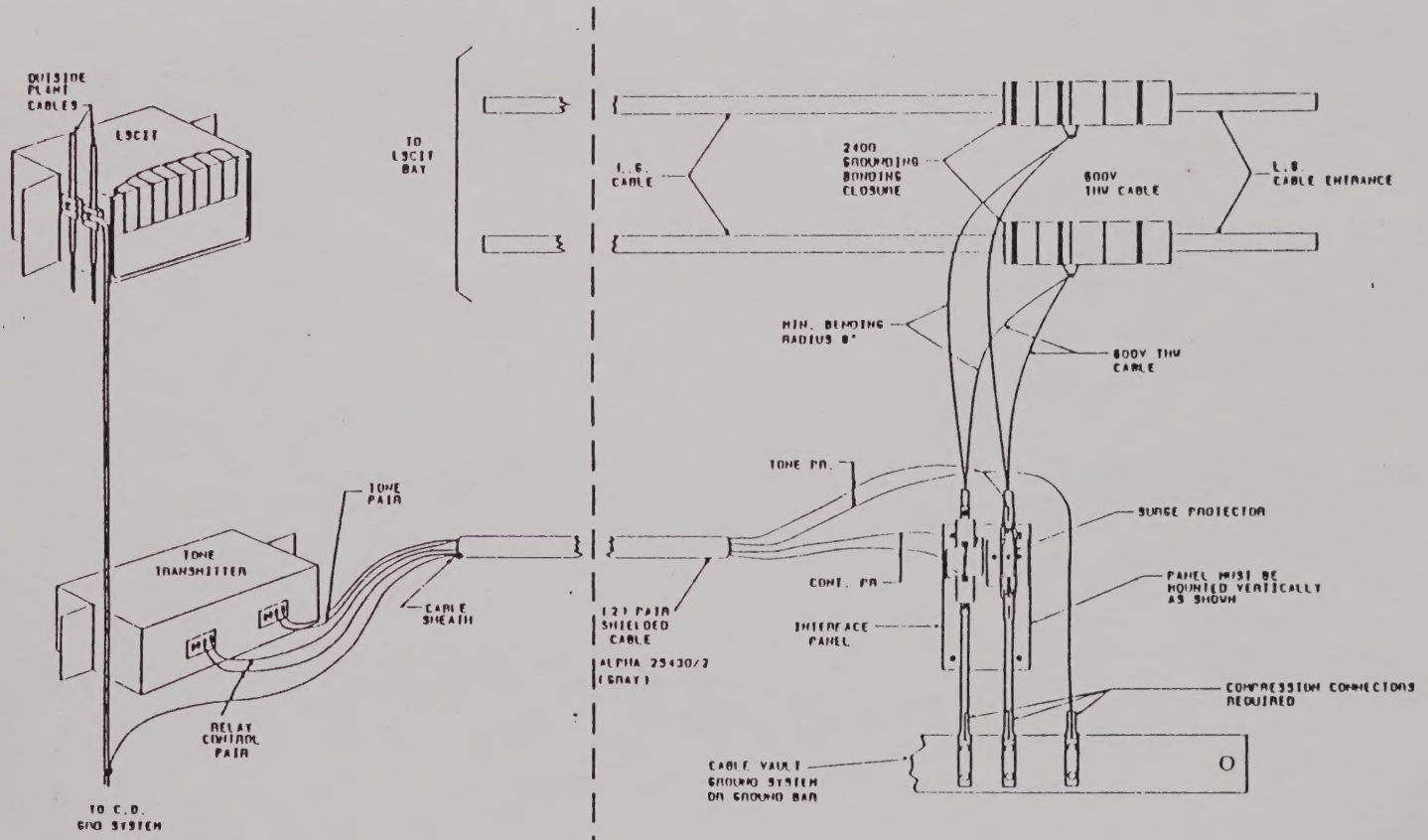
TRANSMITTING ARRANGEMENT FOR CENTRAL OFFICE APPLICATION

TWO DIRECTION FEED



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CABLE GROUND CONTROL
REMOTE CABLE LOCATION TONE TRANSMITTER ARRANGEMENT

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Radiodetection Corporation
35 Whitney Road
Mahwah, NJ 07430
U.S.A.
telephone (201) 848 8070
telex 317275 Locate Rdg
fax (201) 848 1303

Radiodetection Limited
Western Drive
Bristol BS14 0AZ
telephone (0272) 630581
telex 44826 Locate G
fax (0272) 891565